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(71) Applicant (for all designated States except US): **YAZAKI CORPORATION** [JP/JP]; 4-28, Mita 1-chome, Minato-ku, Tokyo 108-0073 (JP).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ARAI, Youichi** [JP/JP]; c/o Yazaki Corporation, 1500, Mishuku, Susono-shi, Shizuoka 410-1194 (JP). **SAIGO, Tsutomu** [JP/JP]; c/o Yazaki Corporation, 1500, Mishuku, Susono-shi, Shizuoka 410-1194 (JP). **SATAKE, Shuji** [JP/JP]; c/o Yazaki Corporation, 1500, Mishuku, Susono-shi, Shizuoka 410-1194 (JP). **TAKEMOTO, Hisashi**

[JP/JP]; c/o Yazaki Corporation, 1500, Mishuku, Susono-shi, Shizuoka 410-1194 (JP). **ITO, Ken** [JP/JP]; c/o Yazaki Corporation, 1500, Mishuku, Susono-shi, Shizuoka 410-1194 (JP). **MIYAZAKI, Yoshiya** [JP/JP]; c/o Yazaki Corporation, 1500, Mishuku, Susono-shi, Shizuoka 410-1194 (JP).

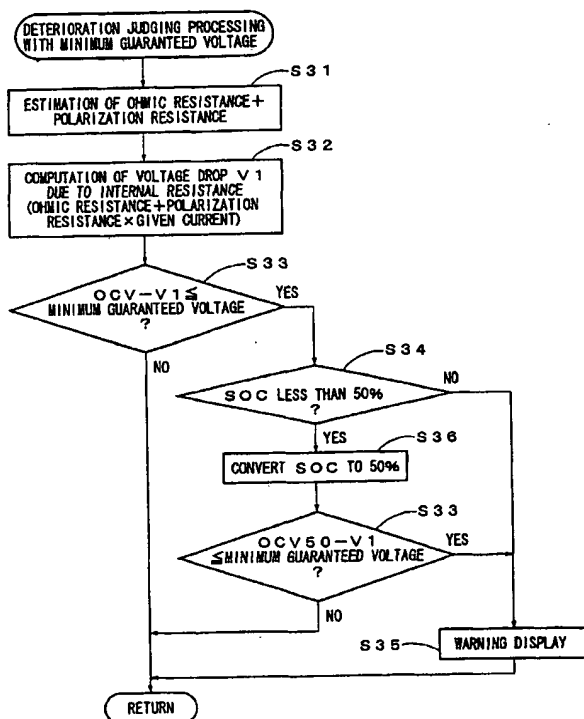
(74) Agents: **TAKINO, Hideo** et al.; 4th Floor, Hiroo SK bldg., 36-13, Ebisu 2-chome, Shibuya-ku, Tokyo 150-0013 (JP).

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[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR JUDGING DETERIORATION OF BATTERY



(57) Abstract: A method and apparatus for judging deterioration of a battery are provided, thereby a correct judgement for the deterioration of the battery can be timely carried out so as to replace the battery with another if it is necessary. The apparatus for judging deterioration of a battery that supplies electric power to a load includes: storing means 23c for storing a minimum guaranteed voltage predetermined as a minimum value of a terminal voltage of the battery 13 when a given current flows into the load; voltage drop computing means 23a for computing a voltage drop due to an ohmic resistance and polarization resistance of the battery occurred in response to a discharge of the battery when a given current flows from the battery into the load; first comparing means 23a for comparing the minimum guaranteed voltage stored in the storing means 23c with a first difference value, which is obtained by subtracting the voltage drop computed by the voltage drop computing means 23a from an open circuit voltage that corresponds to a state of charge upon a start of the discharge of the battery; and first deterioration judging means 23a for judging that the battery is deteriorated if the first difference value becomes equal to or smaller than the minimum guaranteed voltage and the state of charge upon the start of the discharge exceeds a first specific value as a result of the comparison by the first comparing means 23a.



European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP2004/008688

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01R31/36

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 377 833 A (REES GLYNNE) 22 January 2003 (2003-01-22) page 3; figure 3	1
A	-----	10,11
X	US 6 317 697 B1 (FUJII HIROSHI ET AL) 13 November 2001 (2001-11-13) claim 1	1
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 21, 3 August 2001 (2001-08-03) & JP 2001 119862 A (MATSUSHITA ELECTRIC IND CO LTD), 27 April 2001 (2001-04-27) abstract	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

24 September 2004

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03.12.04

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Vytlačilová, L

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/JP2004/008688

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 1995, no. 10, 30 November 1995 (1995-11-30) & JP 7 183050 A (SHIN KOBE ELECTRIC MACH CO LTD), 21 July 1995 (1995-07-21) abstract	1
X	----- JP 2003 132959 A (MATSUSHITA ELECTRIC IND CO LTD) 9 May 2003 (2003-05-09) the whole document	1
X	----- PATENT ABSTRACTS OF JAPAN vol. 2003, no. 09, 3 September 2003 (2003-09-03) & JP 2003 132959 A (MATSUSHITA ELECTRIC IND CO LTD), 9 May 2003 (2003-05-09) abstract	1
A	----- US 2001/022518 A1 (ASAKURA KAORU ET AL) 20 September 2001 (2001-09-20) three diferent possibilities of aging determination - time is measured in which VOC is dropped to V ref, or I cross a theshhold abstract; claim 1 -----	

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2004/008688

## Box II Observations where certain claims were found unsearchable (Continuation of Item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1,10,11 (claims 10 and 11 considered as dependent from claim 1)

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1, 10, 11 (claims 10 and 11 considered as dependent from claim 1)

a method of judging deterioration of a battery by comparing a minimum guaranteed voltage and the voltage drop due to battery resistance

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2. claims: 2, 3, 10 - 13, 18, 19 (claims 10 and 11 considered as dependent from claim 2 resp. claim 3; claims 18 and 19 considered as dependent from claim 12 resp. from claim 13)

a method of judging deterioration of a battery by comparing a minimum voltage and the state of charge of the battery

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3. claims: 4, 5, 6, 10, 11, 14, 15, 18, 19 (claims 10 and 11 considered as dependent from claim 4; claims 18 and 19 considered as dependent from claim 14 resp. 15)

a method of judging deterioration of a battery by comparing a estimated dischargeable capacity of the battery

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4. claims: 7, 8, 9, 10, 11, 16 - 19 (claims 10 and 11 considered as dependent from claim 7 resp. claim 8 resp. claim 9; claims 18 and 19 considered as dependent from claim 16 resp. 17)

a method of judging deterioration of a battery by comparing a summed value of a minimum guaranteed dischargeable capacity of the battery

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP2004/008688

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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